

The DC Streets Performance-Based Asset Preservation Experiment – Current Quantitative Results and Suggestions for Future Contracts

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Abstract

Performance-based asset preservation aims to rehabilitate and maintain roadway, roadside, bridge, and tunnel assets, while reducing overall rehabilitation and maintenance costs by encouraging innovative, cost-effective, flexible preservation strategies. The DC Streets contract, an experimental performance-based asset preservation project undertaken by the District of Columbia Department of Transportation (DDOT) and the Federal Highway Administration (FHWA) over the past five years, entails a private contractor maintaining over 75 miles of the National Highway System (NHS) in the District. With the DC Streets Contract, DDOT has attained system condition improvements on the NHS and currently plans to continue using performance-based asset preservation contracts after the conclusion of the DC Streets effort. This paper presents the quantitative results of the DC Streets project to date and offers suggestions for future performance-based maintenance contracts.

BACKGROUND

Local and state Departments of Transportation face a common challenge. FHWA will provide federal-aid funds to construct transportation assets, and they will provide federal-aid funds to re-construct transportation assets, but maintenance funds generally must come out of the local or state agency's budget. This situation provides little incentive for effective maintenance, which can result in an expedited decline in asset conditions system wide, necessitating reconstruction sooner than it should be needed.

The DC Streets project, which has been undertaken over the past five years by the District of Columbia Department of Transportation (DDOT) and the Federal Highway Administration (FHWA), is an experimental project to use federal-aid funds in an attempt to break this cycle, lengthen the life cycle of the assets, and provide better service to the public. The project aims to rehabilitate the condition of the assets to a specified level, and maintain the assets at or above the specified level (Figure 1) under a performance-based asset preservation contracting environment.

This \$70 million federal-aid project was the first urban, performance-based asset preservation effort of its kind in the United States. This was also the first time that FHWA teamed directly with a city government on a program to preserve their highway infrastructure. The project entails a private contractor, VMS Inc. (VMS), managing, rehabilitating and maintaining over 75 miles of the National Highway System (NHS) in the District (Figure 2).

The District's portion of the NHS contains the city's most important and heavily traveled roadways. The DC Streets contract covers all of the NHS roadways, with the exception of those maintained by the National Park Service. The contract includes all transportation infrastructure assets, right-of-way to right-of-way, with the exception of traffic signals. Specifically, the following maintenance categories are included: pavement structures, roadway cleaning, drainage, roadside, traffic safety (i.e., guiderail, barriers, attenuators, pavement markings, signs, lighting), roadside cleaning, roadside vegetation, bridges, tunnels, pedestrian bridges, weigh-in-motion stations, and snow and ice control. The contract includes rehabilitation and maintenance, but it excludes reconstruction.

HOW IS THIS APPROACH DIFFERENT THAN TRADITIONAL MAINTENANCE CONTRACTING?

In traditional maintenance contracting, the owner agency directs a group of contractors to perform specific tasks. The owner agency specifies what work will be done and how it will be done. This traditional approach provides complete power to the owner agency in the ability to direct the work, but also leaves all of the risk on the owner agency to achieve the desired system condition. This desired condition is not always defined, which can lead to maintenance by crisis, rather than taking a programmatic approach to optimize the condition of the system.

In performance-based contracting, the owner agency specifies what they want to achieve (the performance standards), and the contractor freely selects the methods, materials, and techniques that will best meet the performance standards at a system-wide level. The contractor manages and directs the work, and the owner agency monitors progress to ensure that they are getting the performance and system conditions that they are paying for. This arrangement promotes efficiency, optimization of resources, and innovation, and transfers the risk from the owner agency to the contractor.

Advantages / Disadvantages of Performance-Based Contracts from the DC Streets Perspective

DDOT's decision to make the DC Streets project a performance-based contract was based upon the idea that a series of traditional maintenance contracts might be too labor intensive from a management and inspection perspective. By using a broad-based performance-based contract, they took on a monitoring role, thus eliminating the need for a large workforce.

DDOT also felt that a performance-based approach would provide the contractor with increased flexibility. Due to the large scale of this project, the selected contractor needed flexibility and the ability to manage and direct their own work. A performance-based contract provided this, as well as the ability to use innovative methods to accomplish the desired goals. The results that DDOT expected could likely not have been achieved in this amount of time under a traditional contract. With the contractor able to decide how the work was to be performed, many innovative methods evolved from this project. A mobile pothole patcher was utilized, efficiently requiring a crew of one rather than five as in the past. Another technique that was implemented was that the contractor used performance-based contracts with their contractors. These smaller contracts mirrored the contract issued by the owner agency to maintain the system's assets.

A big advantage of the DC Streets Contract was the ability to immediately respond to safety-critical problems. The contractor could immediately respond and not have to wait for a task order from DDOT. Thus, they

were constantly prepared. This was especially beneficial in circumstances such as knocked down light poles, fallen trees, large potholes, or tripping hazard in an active pedestrian area.

Some members of the team thought that it is possible that an IDIQ contract could be as effective. In the beginning, it was believed that the owner agency would not be very involved and this contract would require three quarters of one person's time with minimal contact with the contractor. Throughout the project, the contractor's performance necessitated more attention and review of their progress. The owner agency anticipated more data feedback regarding the condition of the system from the contractor as specified in the RFP, but found they had to start daily and weekly reviews, and incorporate the use of Tracker, an online deficiency tracking system.

However, overall the DC Streets project has allowed DDOT to both improve the condition of the assets on the NHS and allocate their in-house maintenance resources to local neighborhood streets. The effort has also provided local small businesses and residents increased opportunities for employment.

THE DC STREETS PERFORMANCE MEASURES AND STANDARDS

With this type of innovative contracting, performance measures and standards are specified instead of maintenance techniques. While challenges existed with developing the performance measures for such a broad range of assets from scratch, the project team was able to develop a set of measures to evaluate the condition of all assets, as well as the timeliness of the contractor's performance.

The Science Applications International Corporation (SAIC) consultant team worked closely with DDOT and FHWA to develop new measures or find and adjust existing measures to suit the urban environment. This task required the collective experience of many of the contributing individuals, as well as making use of lessons learned from other agencies. However, since this was the first time a performance-based contract was used in an urban setting, many of the lessons learned from other agencies were not applicable.

The result of this effort was a set of 170 performance measures, each of which has five (5) specified levels of service. For each performance measure, the performance standard is defined for this contract as the threshold between levels of service three (3) and four (4). The performance standard designates a "pass" or the minimum acceptable performance.

There are two primary types of performance measures under DC Streets: condition and time critical. Condition performance measures relate to the condition of a specific asset (i.e., size of a pothole). Time critical performance measures relate to the performance of the contractor in responding to a specified critical event (i.e., duration to patch a pothole). Table 1 provides examples of performance measures under the contract and their associated levels of service. Such measures, along with the lessons learned from the project, may be used by agencies across the country as a basis for new performance-based programs.

QUANTITATIVE RESULTS OF THE DC STREETS PROJECT

Performance against the defined standards is measured on a daily, monthly and annual basis. VMS and DDOT measure performance daily in the field. Staff members of each organization are in the field every day inspecting the system condition and noting deficient areas, and VMS maintains a daily work log for the project.

The monthly review is a subjective windshield survey, while the annual review is an objective engineering evaluation of performance under the contract. Both time critical and condition-related performance measures are considered in the evaluations. DDOT, VMS, FHWA and SAIC conduct the monthly reviews. The SAIC consultant team conducts the annual reviews.

Monthly Results

Each month, members of the DC Streets team perform a subjective evaluation of the condition of the assets. Figure 3 shows the process for the evaluations. The rating personnel are kept relatively consistent to help ensure comparability of the results from month to month. The monthly evaluations are video-recorded and distributed on DVD. A report for each evaluation is also generated. These deliverables help the contractor plan and perform work based on the deficiencies noted during the survey.

Evaluation routes are chosen randomly from a set of eight routes, each of which covers roughly two-thirds of the entire network. The combined routes cover the entire network. Evaluators assign subjective ratings of good, fair, and poor at the maintenance element level using an evaluation form. The evaluator assigns a rating of good if he/she believes that the maintenance element meets the performance standards. The evaluator assigns a rating of fair if he/she feels that the maintenance element may or may not meet the performance standards, and assigns a

rating of poor if he/she believes that the condition of the maintenance element is clearly below the performance standards. Figure 4 provides a graphic illustration of the scoring trends through Month 59.

While Figure 4 is useful, it can be difficult to interpret from an overall performance perspective. Managers from the various partner organizations wanted a single score to compare monthly performance. Thus, the project team developed a monthly score computed from the proportions of subjective good, fair, and poor ratings assigned by the evaluation team. The proportion of good, fair and poor ratings applies to all maintenance elements combined. The proportion of good ratings is multiplied by a factor of 100, the proportion of fair ratings by 50, and the proportion of poor ratings by 0. The resulting values are added together to obtain the score out of 100 (Figure 5). Thus, if all of the ratings assigned were good, the score would be 100. If all of the ratings were fair, the score would be 50, and if all of the ratings were poor, the score would be 0. These scores are not directly comparable to the objective annual evaluation scores; they are based on the same performance standards, but they operate on different scales.

It can be seen in Figure 5 that progress has roughly followed the theoretical asset preservation curve shown in Figure 1. We have had some ups and downs in performance, but the figure shows that subjectively, the condition of the assets has improved and has been maintained at that higher level.

While the monthly evaluations are subjective, they provide a valuable, frequent measure of how the project partners are feeling about the project.

Annual Results

The purpose of the annual evaluation is to provide an evaluation of the condition of the assets and the timeliness of contractor response against the performance standards. Teams of subject matter experts perform this evaluation by rating the assets on randomly selected sample segments and rating time critical performance from DC NHS Tracker Database entries. Figure 6 shows the processes for the annual evaluations.

Most annual ratings are performed with an approximate 10% sampling rate. The SAIC team analyzes the data and uses the results to evaluate performance against the appropriate performance standards. For the final annual evaluation, a 20% sample may be used to provide a more comprehensive view of the project's status. A comprehensive report is provided to the project partners to present the results of each annual evaluation. Similar to the monthly deliverables, this annual deliverable helps the contractor to plan work.

Resulting scores are entered into a scoring spreadsheet with all the performance measures for each applicable test segment; an overall score, as well as a score for each maintenance category, is computed. The resulting score for each performance measure is incorporated equally into its maintenance category score.

For this paper, in order to focus on the condition of the assets over time, and to be able to compare these conditions to pre-DC Streets conditions, we removed the time critical performance scores. The resulting scores without time critical performance data for the Year 4.5 evaluation are provided in Table 2. For this evaluation, the total score excluding time critical performance data was 101, but including time critical performance data resulted in a total score of 92. Figure 7 shows the overall score trend (time critical performance excluded) throughout the course of the project. A score of 100 indicates that, on average, the performance standards were met; the dark horizontal line in Figure 7 represents the minimum acceptable condition.

Because the weight for each maintenance category varies according to their relative importance to the project, the score as a percentage is also provided in Table 2. A weighting exercise, which assigned a unique weight to each maintenance category, was performed at the start of the project. A percentage score of 100 means that the performance standards were met on average. The maximum possible percentage score for any maintenance category is 125%, which would mean that a score of five (5) was assigned to every test segment inspected within that maintenance category. Multiple weighted averages are used in the computation including weights by sample, segment length, and relative performance measure importance within the specific maintenance category.

On average, the drainage, roadside (i.e., curbs, gutters, sidewalks), tunnels, traffic safety (i.e., pavement markings), and snow and ice control categories met or exceeded the performance standards. Roadway cleaning, roadside vegetation, and miscellaneous assets (i.e., pedestrian bridges, WIM) nearly met the performance standards with scores of 90 and above. Pavement structure, bridges, and traffic safety (i.e., guardrails, barriers, attenuators) received scores between 80 and 89. Traffic safety (i.e., signs) and traffic safety (i.e., lighting) did not receive scores of 80 or above.

SUGGESTIONS FOR FUTURE PERFORMANCE-BASED ASSET PRESERVATION AND MAINTENANCE CONTRACTS

The DC Streets Project partners have learned numerous valuable lessons over the course of the contract. The subsections below provide some suggestions for future performance-based preservation and maintenance contracts. These suggestions are based on real-world, on the ground experience, and we have grouped them by project phase for the convenience of the reader. It should be noted that a number of these suggestions also apply to owner agencies that are using a performance-based approach with their in-house crews.

Project Development and Award

Agencies should take advantage of the experience of others and avoid beginning this type of effort from scratch. Over the past 5 years, numerous agencies across the United States have undertaken performance-based maintenance contracts and can share valuable lessons learned. Taking advantage of these lessons learned can help to avoid costly mistakes and ensure success.

Work with your FHWA Division Office to determine if some or all of your conceptual project might be eligible for federal-funding. More and more maintenance and rehabilitation activities are becoming eligible for federal-aid funds.

If possible, use a best-value award process. This process allows you to select a qualified contractor that offers you the best combination of price, technical/management/staffing approach, past performance, etc. For federally-funded efforts, you can apply to use a best-value award through the SEP-14 process.

Determine the compatibility of a performance-based contract with your contracting regulations up front, and be innovative in making the contract fit the regulations. Your contract regulations may not allow for long-term contracts or penalties such as disincentive fees. Find this out up front and work around the obstacle.

Allow enough time for RFP development, approval, advertising, and award. You should not try to rush the process, especially if performance-based contracting is new to your agency and contractor pool. Have lots of meetings to share information and discuss ideas.

Specify whether the contract will include rehabilitation and maintenance, or just maintenance. Also, you need to specify what level of rehabilitation is necessary. A good way to do this is to provide examples of what is included and what is excluded.

Determine who needs to review/approve the RFP and involve them early in the process. By following this suggestion, the approval process should be much more efficient.

Specify how innovative methods/technologies will be approved if they are different from the standard specifications. By specifying a reasonable process in the RFP package, you will avoid risk and reduce uncertainty. A good approach is to form an evaluation panel for innovations.

Specify the relationship between contract signing and NTP and the payment implications of this relationship. You do not want to get stuck paying full contract payments while the contractor is mobilizing. The contractor will also want to clearly understand the projected cash flow so that they can plan for credit as needed.

Plan out and specify what happens if the project does not work. It is better to have everyone understand this up front so that they can plan accordingly. The end of the honeymoon period is too late for doing this.

Identify the PM/PE/COTR and involve him/her throughout the entire process. By doing this, you ensure that the person who will be running the process has participated in the decision-making that formed the contract and picked the successful contractor.

Make incentives achievable and worthwhile. You want these to drive the contractor's performance. If they are not achievable or worthwhile, the contractor will not go the extra mile to obtain them.

Include disincentives to push performance. Try to avoid having a penalty-free contract, as that can result in bad performance. However, it must be recognized that you are going to pay for these penalties up front due to the additional risk.

Incentives and disincentives should be equal. This allows fairness to both the owner agency and the contractor. If you have too many disincentives or penalties, it might be a great contract from the owner-agencies' perspective, but you also might have nobody bid on it.

Performance standards should be SMART – Specific, Measurable, Achievable, Results-Oriented and Timely. You should put each of your performance standards through this test. If they do not pass, revise them until they do.

When writing performance standards, be specific – make sure that you cover everything. Describe in detail what you want to achieve. That will increase the probability of achieving it.

Include time-response standards for each condition standard. By doing so, the contractor has to respond to and fix deficiencies.

5-level measures are more informative than pass/fail measures. You will want to know if the sample failed or passed by a little bit or a lot.

Test the standards in the field before advertising your RFP/IFB. This will give you a chance to see if they are achievable and measurable. Developing the performance measures and standards is an iterative process, so do not be surprised if adjustments are needed.

Include asset inventory and condition data in the RFP. The more of this information that you include, the less risk there will be for the contractor's in developing their prices.

Clearly define what it means to meet the performance standards and make sure that you and the contractor have the same understanding before you sign the contract. The most important thing to specify is whether it is acceptable to meet the specified conditions on average or whether each tested sample must meet the performance standard.

Using longer contract periods generally reduces the risk for the contractor (and the price for you). While having base and option years is good from the perspective of what happens if things go wrong, having a longer base period will likely reduce the price. You will need to find the right balance.

When developing Performance Standards, it is important to consider how they will be measured / evaluated and define this in the solicitation. You will need to specify:

- Who will collect and analyze the information?
- Is specialized equipment required?
- How often will performance be evaluated?
- Will the evaluation be subjective or objective?
- Who pays?
- What happens if a performance standard is not met?

Contract Management and Measuring Performance

Agencies should specify the process of measuring performance clearly in the RFP. This process will impact pricing because it affects the contractor's risk.

The agency implementing this type of contract will need to choose between sampling segments for reviews or look at 100% of the system. This is based on the philosophical question of whether you want to obtain an indicator of the contractor's performance, or whether you want to drive the contractor's work plan at the detailed level. The owner agency's role in performance measurement should be the former.

If sampling is selected, the agency should choose the samples randomly to resist the temptation of looking solely at problems. Looking solely at the problem areas does not give a fair indication of the condition of the system. It can also heavily bias scoring.

Capture the performance reviews on video. This provides a lasting record of the condition of the system at various stages of the contract. The videos are also invaluable for solving project disputes and for obtaining information such as missing sign content and placement.

Weighted averages work for generating summary scores, but they can hide problems if you just focus on the summary scores. You will need to generate summary scores (overall, by maintenance category, etc.) to provide valuable information to different levels of management. However, the project-level personnel should be focused on the sample-levels scores to ensure that deficiencies noted get addressed.

Be fair when evaluating performance. It is best to use a third party independent evaluator to help avoid project biases (such as pet peeves) impacting scoring that is supposed to be objective.

Partnering works, but it should be a two-way street. Partnering is very effective for solving minor disputes and discussing difficult matters in a facilitated environment. However, you need to make sure that one side does not win all of the time. These contracts cannot cover every conceivable issue, but the issues that arise can be worked out if you use partnering effectively.

Manage expectations over the course of the contract. All of the infrastructure deficiencies will not magically go away overnight on the first day of the contract. Set and communicate reasonable timeline expectations to ensure that people are informed of the planned progress. Also, because of the nature of the work, most of the

performance standards do not call for perfection, as this would likely be unachievable. Make sure that people know the standards and are not expecting perfection.

You will need to actively monitor the contract, and thus, you need to plan for appropriate personnel and equipment resources. These resources include a project manager, one or more field inspectors, vehicles, testing equipment, video cameras, evaluation crews, etc. A consultant can provide the equipment and testing crews in an efficient and cost effective manner.

While these contracts provide nice planned spending budgets, include some discretionary funds for out of scope emergencies. Emergencies will arise that will not be covered by the contract, but that could be easily addressed by the contractor. If you have some discretionary funding available, you can get the contractor to work quickly with a change order.

Hold regular project-level meetings. Bi-weekly operations meetings help to keep issues on the table until they are solved. These meetings are also helpful to communicate owner agency priorities and obstacles that the contractor is running into.

Make use of a centralized communications hub in the form of a web portal. Web portals allow all project documents to be posted in a single accessible location, and provide an easy method of meeting coordination through the process of calendar sharing.

You will need a means of submitting service requests and tracking responses in a centralized, trackable, accurate manner. A major factor in communicating and recording deficiencies is an effective set of IT tools. For the DC Streets project, we developed a software package called TRACKER for this purpose. It is a web-based tool that enables deficiency notifications, and performance summary reporting. Resist the temptation of just calling in deficiencies by phone because the information and response becomes very hard to track.

Planning for Follow-On / Transition Efforts

Start early! Two years before the end of your current contract is not too early. Budgetary planning and RFP/IFB development and updating takes time.

Bring stakeholders back together to determine the future direction. Some organizations within the agency might want to add or remove services. By bringing everyone back to the table early, you will avoid last minute surprises that can leave the public without critical services.

Re-design your solicitation based on lessons learned and new industry information. Avoid the temptation of just sticking the same RFP/IFB package out on the street again. There is always something that needs to be tweaked.

Be realistic with budget estimates – they must reflect scope changes and inflation. Even if you have not changed the scope, the follow-on contract is not going to be the same price as the initial contract. Also, you should try to avoid the temptation of adding scope while trying to cut the budget estimates.

Advertise early – leave time for negotiations, award, mobilization, and transition. This becomes especially important if there is going to be a change in contractor.

Come to a mutual agreement with the current contractor on what it means to be finished. You do not want to have the contract end with a bunch of deficiencies still out there. At the same time, if major infrastructure damage occurs on the last day of the contract, is it fair to make the contractor repair it?

SUMMARY

DDOT and FHWA partnered together on the experimental DC Streets Performance-Based Asset Management Contract. The contract has been effective in improving the conditions of the National Highway System transportation infrastructure assets within D.C., and the project has provided numerous, invaluable lessons learned that can be used as suggestions by other agencies considering a performance-based approach for rehabilitation and maintenance.

DDOT plans to continue using performance-based asset preservation contracts after the conclusion of the DC Streets effort. Specifically, the agency currently is expanding the application of the concept District-wide for assets such as lighting and tunnels. DC Streets II, a follow-on contract that will include several DC NHS asset categories, also is being developed.

ACKNOWLEDGEMENTS

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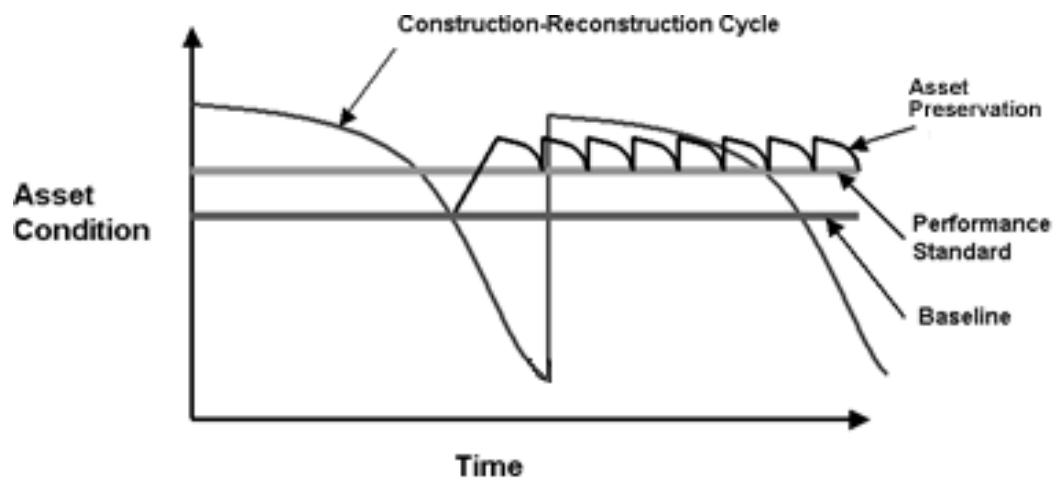


FIGURE 1 Traditional versus performance-based maintenance cycles.

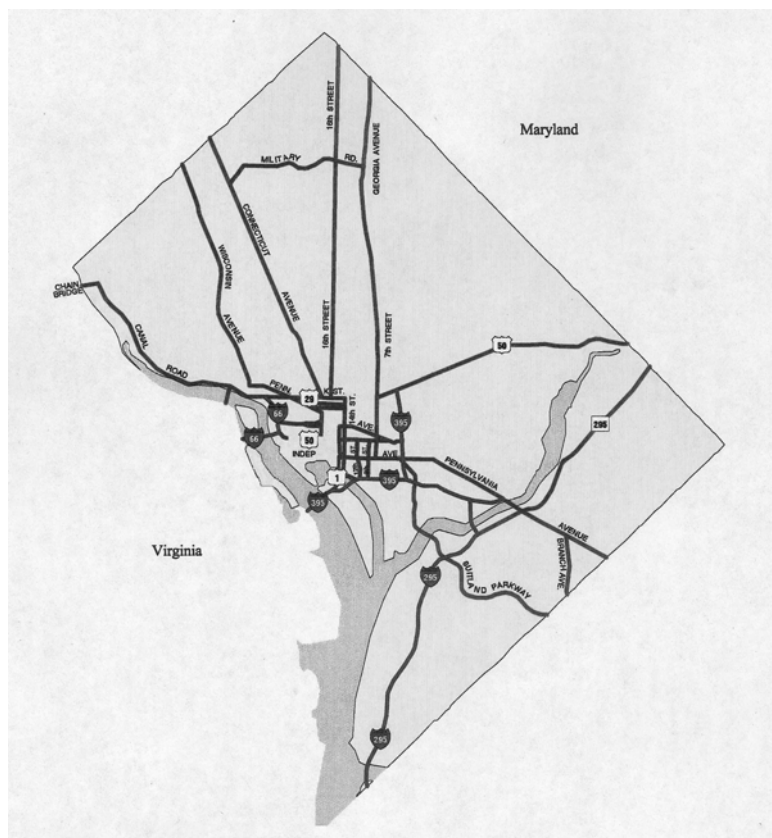


FIGURE 2 Project coverage map.

TABLE 1 Example Performance Measures and their Associated Levels of Service

Maintenance Category	Maintenance Element	Performance Measure	LOS #	Excellent 5	Good 4	Fair 3	Poor 2	Very Poor 1
Pavement Structure	Pavement Surface	IRI – Roads reconstructed in the past 5 years	1	IRI<110	110≤IRI<181	181≤IRI<250	250≤IRI<320	IRI≥320
		IRI – Roads not reconstructed in the past 5 years	2	% of pavement with IRI<181 increased by 10% or more	% of pavement with IRI<181 remained the same or increased up to 10%	% of pavement with IRI < 181 decreased up to 10%	% of pavement with IRI <181 decreased from 10 to 20%	% of pavement with IRI <181 decreased more than 20%
			3	% of pavement with IRI≥250 decreased by 10% or more	% of pavement with IRI≥250 remained the same or decreased up to 10%	% of pavement with IRI≥250 increased up to 10%	% of pavement with IRI≥250 increased from 10 to 20%	% of pavement with IRI≥250 increased more than 20%
		PCI – Roads reconstructed in the past 5 years	4	PCI>90	90≥PCI>80	80≥PCI>60	60≥PCI>50	PCI≤50
		PCI – Roads not Reconstructed in the past 5 years	5	% of pavement with PCI>80 increased by 10% or more	% of pavement with PCI>80 remained the same or increased up to 10%	% of pavement with PCI>80 decreased up to 10%	% of pavement with PCI>80 decreased from 10 to 20%	% of pavement with PCI>80 decreased more than 20%
			6	% of pavement with PCI≤60 decreased by 10% or more	% of pavement with PCI≤60 remained the same or decreased up to 10%	% of pavement with PCI≤60 increased up to 10%	% of pavement with PCI≤60 increased from 10 to 20%	% of pavement with PCI≤60 increased more than 20%
		Friction Number	7	Skid Number > 45	45 ≥Skid Number > 40	40 ≥Skid Number > 35	35 ≥Skid Number > 30	Skid Number ≤ 30

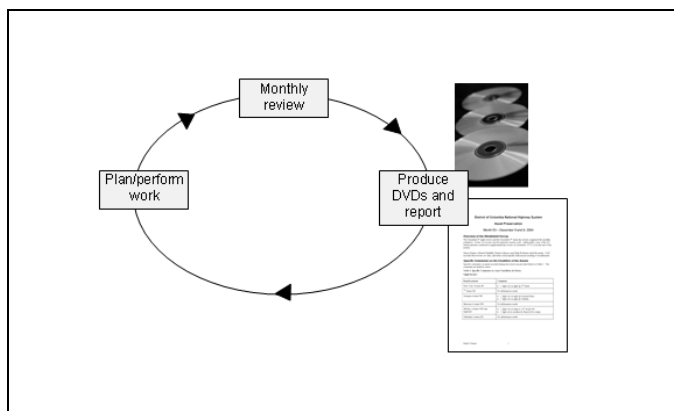


FIGURE 3 Monthly evaluation process.

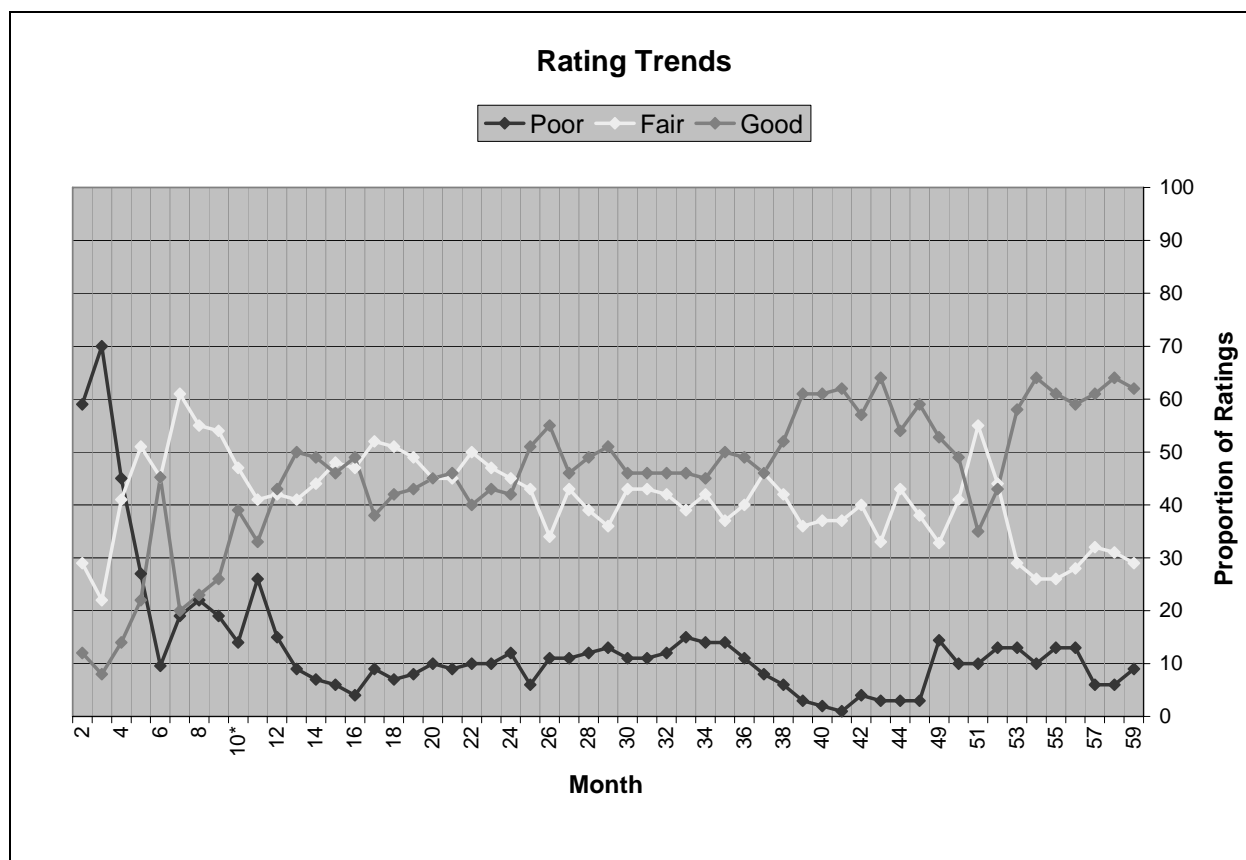


FIGURE 4 Full trend in proportions of ratings.

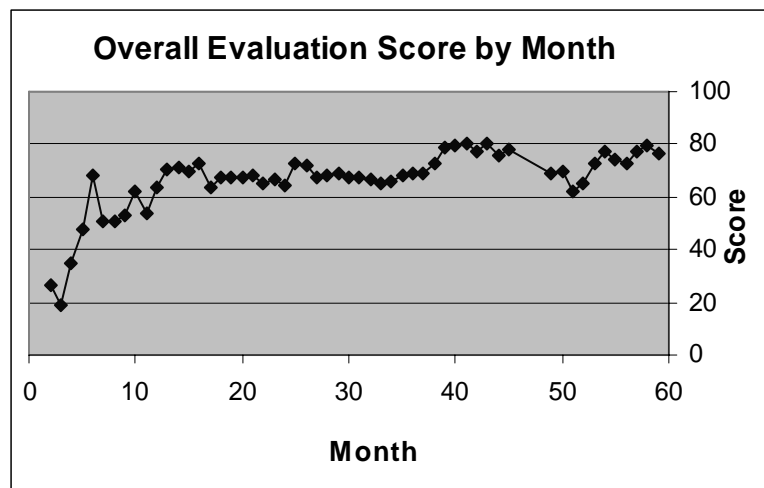


FIGURE 5 Overall evaluation score by month.

TABLE 2 Resulting Scores of the Year 4.5 Evaluation

Maintenance Category	Score	Maximum Score	%
Pavement Structure	8.6	9.1	95
Roadway Cleaning	7.7	7.3	106
Drainage	7.3	6.8	107
Roadside (Curbs, Gutters, Sidewalks)	7.6	6.7	113
Traffic Safety: Guardrails, Barriers and Attenuators.	8.1	7.3	111
Roadside Cleaning	8.0	6.6	120
Roadside Vegetation	5.8	6.1	96
Bridges	7.3	8.2	89
Tunnels	8.7	8.7	101
Traffic Safety: Pavement Markings	7.1	6.9	103
Traffic Safety: Signs	6.1	6.6	92
Traffic Safety: Lighting	6.4	7.0	91
Miscellaneous Assets: Ped. Bridges and WIM	4.9	5.5	90
Snow and Ice Control	7.2	7.2	100
Total Score	100.8		

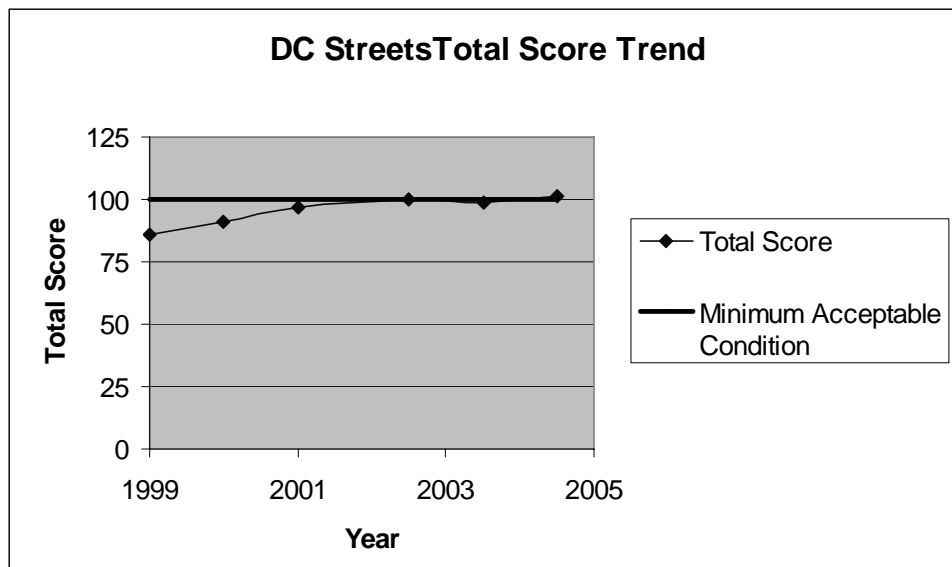


FIGURE 7 Overall score trend throughout the course of the project.